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10/758,368	01/15/2004	Simon C. Steely JR.	200313752-1	5294

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EXAMINER	
ROJAS, MIDYS	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/758,368	STEELY ET AL.	
	Examiner	Art Unit	
	Midys Rojas	2185	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *1/15/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 1/15/2004 has been considered by the examiner.

Drawings

2. The drawings filed on 1/15/2004 have been accepted by the examiner.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

4. Claim 25 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear what applicant means by "requests in the forward channel do not block". It is not understood what it is that the requests in the forward channel are not blocking and, furthermore, it is not understood what this has to do with the directory based cache coherency protocol. For examination purposes, the examiner will interpret this claim as claiming a system that employs a directory-based cache coherency protocol.

5. Claims 10-12 recite the limitation "the network of claim 9" in line 1. There is insufficient antecedent basis for this limitation in the claim. Claim 9 does not claim a network, but instead claims a system.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Peir et al. (6,711,662) in view of Martin et al. (2002/0133674).

Regarding Claim 1, Peir et al. discloses a multi-processor system [Fig. 1] comprising: an owner predictor 22 [Fig. 2] that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data [makes prediction about next requester of a given data block, Col. 2, lines 60-67; informs the predicted next requester about the current owner of the data block, Col. 3, lines 40-54; the next requester is represented by the system of one of the many processor 121, which includes its own prediction facility 22, Fig.2], the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data [see current owner table 25 which includes a tag and current owner identification, Fig. 2]. Peir et al. does not teach the prediction facility having a predictor controller. Martin et al. discloses a predictor that is part of a controller [paragraph 0071]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to associate the prediction facility of Peir et al. with a controller since doing so would provide for an unit to properly coordinate the functions of the predictor and also control communications between the predictor and the other components of the invention.

Regarding Claim 2, Peir et al. discloses the system wherein the owner predictor provides an ownership update message when the block of data at the owner node transitions to one of a modified or exclusive state [informs the predicted next requester about the current owner of the

data block... whenever a new owner of the data block is identified, Col. 3, lines 40-46. If a new owner is being identified, then the ownership state of the block has been modified].

Regarding Claim 3, Peir et al. discloses the system further comprising a requesting node that provides a first request for the block of data to a home node [sends an inquiry to the home directory 20, Col. 3, lines 63-67], the requesting node being operative to provide a second request for the block of data to at least one predicted node [the processor will request the data block directly from the current owner, Col. 3, lines 55-62] in parallel with first request [...in parallel with the request that the processor send to the current owner, Col. 3, lines 66-67], the at least one predicted node being selected by an associated one of the plurality of owner predictors [the prediction facility makes a prediction for a data block whenever a new owner of the data block is identified, Col. 3, lines 42-44].

Regarding Claim 4, Peir et al. discloses the system wherein the requesting node receives a coherent copy of the block of data from at least one of the home node and the at least one predicted node [processor C responds to the request by sending data X back the processor P if processor C owns data X, Col. 4, lines 57-59], the requesting node consuming a first coherent copy of the block of data received [in receiving the data from processor C, the requesting processor consumes it by performing what ever access operation it was requesting the data for, Col. 4, lines 51-67].

Regarding Claim 5, Peir et al. disclose the system wherein a cached copy of the block of data exists at the owner node, the home node issuing a third request for the block of data to the owner node [home directory routes the request to the current owner of data X... Col. 4, lines 65-67].

Regarding Claim 6, Peir et al. discloses the system wherein the system employs a directory-based cache coherency protocol [assure cache coherency, information about at least a portion of data blocks in the memory unit is recorded and stored in a directory 20, Col. 1, lines 58-62], the home node further comprising a directory that maintains directory state information associated with the block of data [Col. 1, line 62-Col. 2, line 4], the home node issuing the third request to the owner node based on the directory state information indicating that the owner node has an exclusive cached copy of the block of data [home directory checks if processor C is the actual current owner... otherwise, the prediction facility updates the prediction table to reflect the correct ownership of data X. The home directory routes the request to the current owner of data X... Col. 4, lines 60-67].

Regarding Claim 7, Peir et al. discloses the system wherein the owner node provides one of (i) a response to the home node [the home directory routes the request to the current owner of data X... the current owner returns data X to processor P in response to the request that was routed by the home directory, Col. 4, lines 60-67] and (ii) a response to the home node and to the requesting node, the owner node providing the response based on a state of the cached copy of the block of data at the owner node [see Col. 4, lines 51-67].

Regarding Claim 8, Peir et al. discloses the system wherein the at least one predicted node comprises the owner node [the prediction facility makes a prediction for a data block whenever a new owner of the data block is identified, Col. 3, lines 42-44], the owner node having an exclusive cached copy of the block of data [verifying that processor C is the actual current owner... Col. 4, lines 51-67] and providing a data response to the requesting node [processor C responds to the request by sending data X back the processor P if processor C owns

data X, Col. 4, lines 57-59], based on which of the second request and the third request arrives at the owner node first [request are granted in the order that they are received... the next requester will read or write the data block before any other processors that are not the current owner, Col. 2, lines 53-59].

Regarding Claim 9, Peir et al. in view of Martin et al. discloses the system wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor [prediction based on ownership history of the data block] and a second component that stores ownership update messages provided from the owner predictor [history can be stored in the prediction facility in the form of a prediction table indexed by the address of the data block, Col. 3, lines 3-11]. Martin et al. teaches the integration of a controller in to the system of Peir, as discussed in Claim 1.

Regarding Claim 10, Peir et al. discloses the network [network 14, Col. 5, lines 7-8] wherein the second component stores the provided update messages according to a first-in-first-out (FIFO) arrangement [Peir discloses storing ownership information in a FIFO table, Col. 4, lines 29-30].

Regarding Claim 11, Peir et al. discloses the network [network 14, Col. 5, lines 7-8] wherein the second component is operative to prioritize update messages according to a determination at the first component [history can be stored in the form of a prediction table indexed by the address of the data block, Col. 3, lines 3-11].

Regarding Claim 12, Peir et al. discloses the network [network 14, Col. 5, lines 7-8] wherein the processor employs the given owner predictor 22 to determine a predicted owner for

a given block of data [the prediction facility makes a prediction for a data block whenever a new owner of the data block is identified, Col. 3, lines 42-44], the given owner predictor selecting between accessing the first component and the second component according to the frequency in which ownership update messages associated with the block of data have been received from the owner predictor control [prediction is done based on ownership history, Col. 3, lines 3-11].

Claim 13 is rejected using the same rationale as that of Claim 1 wherein the multi-processor network is represented by the multiprocessors of Figure 1 and the network 14 [Col. 1, lines 50-61 and Col. 5, lines 7-10]. Peir et al. also discloses a first processor [one of the processors of Fig. 1] that includes a cache having a plurality of cache lines associated with respective blocks of data [cache 122], one cache line transitioning to an ownership state based on a response to a request provided by the first processor [prediction facility updates the prediction table to reflect the ownership of data X in response to the request from processor P, Col. 4, lines 39-67]; and a second processor [one of the processors of Fig. 1] that includes an associated owner predictor [Fig. 2, 22].

Regarding Claim 14, Peir et al. discloses the network wherein the owner predictor provides the update message to at least one other processor at a multi-processor node that is shared by the first processor [next requester can be a group of processors, Col. 3, lines 34-39; and the predictor 22 informs the next requester about the current owner of the data block, Col. 3, lines 40-42. Since the requestors are many, the predictor informs the group of processors about the current owner and the group of processors represents processors in a multi-processor node].

Regarding Claim 15, Peir et al. discloses the network wherein the owner predictor control broadcasts the update message to each of a plurality of processors comprising the multi-

processor network [next requester can be a group of processors, Col. 3, lines 34-39; and the predictor 22 informs the next requester about the current owner of the data block, Col. 3, lines 40-42. Since the requestors are many, and the group of processors may encompass all the processor, the predictor informs the group of processors about the current owner and doing this is equivalent to broadcasting the information since all processors will be informed].

Regarding Claim 16, Peir et al. discloses the network wherein the owner predictor control monitors available bandwidth in the network and provides the update message based on the available bandwidth relative to a threshold value [minor increase in traffic on interconnection network 14 due to information sent to the incorrectly predicted processor, Col. 4, lines 7-16].

Regarding Claim 17, Peir et al. discloses the network further comprising a home node having a directory that includes directory state information associated with the plurality of cache lines [assure cache coherency, information about at least a portion of data blocks in the memory unit is recorded and stored in a directory 20, Col. 1, lines 58-62 and Col. 1, line 62-Col. 2, line 4], the directory state information being updated to reflect the one cache line transitioning to the ownership state, and the owner predictor control providing an update message in response to the updating of the directory state information [the prediction facility updates the prediction table to reflect the ownership of data X... current owner returns data to processor P and home directory, Col. 4, lines 51-67].

Claim 18 is rejected using the same rationale as that of Claim 3.

Regarding Claim 19, Peir et al. discloses the network wherein the at least one predicted node comprises the first processor based on the update message [Col. 2, lines 53-67].

Regarding Claim 20, Peir et al. discloses the network further comprising an unordered network interconnect that enables communication of requests, responses, and update messages among at least the first processor, the second processor and the home node [Col. 5, lines 7-25].

Regarding Claim 21, Peir et al. discloses a system comprising:

a requesting node that provides a first request for the block of data to a home node [sends an inquiry to the home directory 20, Col. 3, lines 63-67], the requesting node being operative to provide a second request for the block of data to at least one predicted node [the processor will request the data block directly from the current owner, Col. 3, lines 55-62] in parallel with first request [...in parallel with the request that the processor send to the current owner, Col. 3, lines 66-67], the requesting node receiving a coherent copy of the block of data from at least one of the home node and the at least one predicted node [processor C responds to the request by sending data X back the processor P if processor C owns data X, Col. 4, lines 57-59];

the at least one predicted node being selected by an associated one of the plurality of owner predictors [the prediction facility makes a prediction for a data block whenever a new owner of the data block is identified, Col. 3, lines 42-44].

an owner predictor 22 [Fig. 2] that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data [makes prediction about next requester of a given data block, Col. 2, lines 60-67; informs the predicted next requester about the current owner of the data block, Col. 3, lines 40-54; the next requester is represented by the system of one of the many processor 121, which includes its own prediction facility 22, Fig.2], the update message comprising an address tag associated with the block of data and an identification associated with

an owner node of the block of data [see current owner table 25 which includes a tag and current owner identification, Fig. 2]. Peir et al. does not teach the prediction facility having a predictor controller. Martin et al. discloses a predictor that is part of a controller [paragraph 0071]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to associate the prediction facility of Peir et al. with a controller since doing so would provide for an unit to properly coordinate the functions of the predictor and also control communications between the predictor and the other components of the invention.

Regarding Claim 22, Peir et al. discloses the system wherein the at least one coherent copy of the block of data is returned to the requesting node as a response in a response channel [processor C responds to the request by sending data X back the processor P if processor C owns data X, Col. 4, lines 57-59], the response being provided by the at least one predicted node [the response is sent via network 14, therefore network 14 represent the response channel, Col. 5, lines 7-25].

Claim 23 is rejected using the same rationale as that of Claim 5.

Regarding Claim 24, Peir et al. discloses the system wherein the first request is provided in a request channel [the processor requests data block directly from current owner, Col. 3, lines 60-62], and the second [processor sends an inquiry to the home directory in parallel with the request, Col. 3, lines 65-67] and third [home directory routes request to the current owner of data X] requests are each provided in a forward channel. Since the first and second requests are sent in parallel, this means that two channels must be available for the sending of data.

Claim 25 is rejected using the same rationale as that of Claim 6.

Claim 26 is rejected using the same rationale as that of Claim 8.

Regarding Claim 27, Peir et al. discloses the system wherein the owner node provides a victim message to the home node and the data response to the requesting node in response to the third request arriving at the owner node prior to the second request [home node routes request to current owner of data X... current owner returns data X to processor P and home directory 20], the home node providing a speculation acknowledgement to the requesting node in response to the victim message from the owner node [if processor C is not the current owner, then the request from processor P will not reach the current owner before directory 20 routes the request... the home directory will respond to processor P's inquiry, Col. 4, lines 51-67].

Regarding Claim 28, Peir et al. discloses the system wherein the owner node provides a victim message to the home node in response to the second request arriving at the owner node prior to the third request [determination that processor C is indeed the current owner], the owner node also providing the data response to the requesting node in response to the second request from the home node [processor C responds to the request by sending data X back to processor P, Col. 4, lines 51-67].

Regarding Claim 29, Peir et al. discloses the system wherein the at least one predicted node further comprises a target node having a cache that includes the data having one of an invalid state and a shared state [block at the current owner has been invalidated by the time the processor's request reaches there, Col. 4, lines 1-2], the at least one predicted node providing a miss response to the requesting node in response to the second request [determination that its invalid], and the owner node providing a data response to the requesting node in response to the third request [home directory will locate the actual owner, Col. 4, lines 1-5, and the current owner will return data X, Col. 4, lines 63-67].

Claim 30 is rejected using the same rationale as that of Claim 21.

Claim 31 is rejected using the same rationale as that of Claims 3-4.

Claim 33 is rejected using the same rationale as that of Claim 12.

Claim 34 is rejected using the same rationale as that of Claim 1.

Claim 35 is rejected using the same rationale as that of Claims 3-4.

Claim 36 is rejected using the same rationale as that of Claim 5.

Claims 37 and 38 are rejected using the same rationale as that of Claim 8.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Midys Rojas whose telephone number is (571) 272-4207. The examiner can normally be reached on M-F 5:30am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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